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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/695,336	10/28/2003	Peter J. Geiss	BUR920010184US2	4852

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EXAMINER	
DOTY, HEATHER ANNE	
ART UNIT	**PAPER NUMBER**
2813	

DATE MAILED: 09/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/695,336	GEISS ET AL.	
	Examiner	Art Unit	
	Heather A. Doty	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 July 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *20-46* is/are pending in the application.

4a) Of the above claim(s) *27-32* is/are withdrawn from consideration.

5)☒ Claim(s) *40-46* is/are allowed.

6)☒ Claim(s) *20-24,26,33,34 and 36-39* is/are rejected.

7)☒ Claim(s) *25 and 35* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless – (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 20-22 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Takemura (U.S. 5,587,326).

Regarding claims 20-22, Takemura teaches a bipolar transistor comprising a collector (column 3, lines 39-41); a base (column 3, lines 61-62); and a polysilicon emitter containing a dopant species (arsenic—column 5, lines 6-14) and a polysilicon grain size modulating species (carbon—column 4, lines 61-65; Fig. 4; Applicant discloses in the instant specification that an ion implant of carbon will change the polysilicon grain size, pg. 7, line 17 – pg. 8, line 5).

Regarding claim 24, Takemura teaches the bipolar transistor of claim 20 and further teaches that the resistance of the emitter of the bipolar transistor is higher than the emitter of an identical bipolar transistor fabricated without said polysilicon grain size modulating species (column 5, lines 18-22).

Claims 20, 23, 33, 34, 36, and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Niitsu (U.S. 5,137,839), with Takemura (U.S. 5,587,326) used to establish inherency for claim 36.

Regarding claims 20 and 23, Niitsu teaches a bipolar transistor comprising a collector (column 2, lines 51-55); a base (column 2, line 66 – column 3, line 2); and a

polysilicon emitter containing a dopant species (arsenic or phosphorus—column 3, lines 7-10) and a polysilicon grain size modulating species (carbon, column 3, lines 19-23; Applicant discloses in the instant specification that an ion implant of carbon will change the polysilicon grain size, pg. 7, line 17 – pg. 8, line 5), wherein the base current of said bipolar transistor is higher or lower than the base current of an identical bipolar transistor fabricated without said polysilicon grain size modulating species (as in claim 23; column 1, lines 33-35—Niitsu teaches that the base current is varied by the grain diameter of polysilicon, so modifying the grain size through a carbon implant will change the base current of the transistor).

Regarding claims 33 and 34, Niitsu teaches a bipolar transistor, comprising a single-crystal silicon collector region (**3** in Fig. 8); a single-crystal silicon base region in said collector region (**7** in Fig. 8); a single-crystal emitter region formed in said base region (**14** in Fig. 8); and a polycrystalline silicon emitter layer (**11** in Fig. 8) in direct contact with a top surface of said emitter region, said emitter layer containing a dopant species (arsenic or phosphorus—column 3, lines 7-10) and a carbon species (column 3, lines 19-23).

Regarding claim 36, Niitsu teaches the bipolar transistor of claim 33, wherein the resistance of said emitter of said bipolar transistor is inherently higher than the emitter resistance of an identical bipolar transistor fabricated without the carbon species (Takemura discloses that polysilicon containing carbon has a higher resistance than carbon-free polysilicon, column 5, lines 18-22).

Regarding claim 37, Niitsu teaches the bipolar transistor of claim 33, wherein a silicon grain size of said polysilicon emitter layer of said bipolar transistor is less than a silicon grain size of a polysilicon emitter layer of an identical bipolar transistor fabricated without said carbon species (Applicant discloses in the instant specification that carbon doping polysilicon results in a silicon grain size that is less than a silicon grain size of polysilicon not doped with carbon, see pg. 7, line 17 – pg. 8, line 5).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 26 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Niitsu (U.S. 5,137,839) in view of Candeleria (U.S. 5,360,986) and Grider et al. (U.S. 6,030,874).

Regarding claims 26 and 38, Niitsu teaches the bipolar transistor of claims 26 and 38 as recited above in regard to claims 20 and 33, but is silent regarding the implant dose and energy of the arsenic and carbon ion implantations.

However, Candeleria teaches implanting arsenic into polysilicon at a dose of 1E15 to 2.3E16 atm/cm^2 and at an energy of 40 to 70 KeV (column 3, lines 59-61), and Grider et al. teaches implanting carbon into polysilicon at a dose of 1E14 to 1E16 atm/cm2 and at an energy of 15 to 35 KeV (column 4, lines 15-17).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to fabricate a bipolar transistor according to the method taught by Niitsu, and look to the teachings of Candeleria and Grider et al. for known ion implantation dose and energy values for implanting arsenic and carbon into polysilicon. The motivation for doing so at the time of the invention would have been to save time and resources by using values already known in the art of semiconductor devices and ion implantation of arsenic and carbon into polysilicon.

Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Niitsu (U.S. 5,137,839) in view of Morishita (U.S. 5,708,281).

Regarding claim 39, Niitsu teaches the bipolar transistor of claim 39 as recited above in regard to claim 33, but does not teach that the base region includes germanium.

Morishita teaches a bipolar transistor with a base region that includes germanium to narrow the band gap (column 11, lines 11-20).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of Niitsu and Morishita by fabricating a bipolar transistor according to the method taught by Niitsu, and further add germanium to the base region, as taught by Morishita. The motivation for doing so at the time of the invention would have been to narrow the band gap, as expressly taught by Morishita.

Allowable Subject Matter

Claims 25 and 35 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 40-46 are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 25, prior art does not teach or suggest, in combination with other claimed limitations, a bipolar transistor with a polysilicon emitter containing both arsenic and antimony.

Regarding claim 35, prior art does not teach or suggest, in combination with other claimed limitations, a bipolar transistor with a polysilicon emitter containing carbon that has a base current lower than the base current of an identical bipolar transistor with a polysilicon emitter not containing carbon. Niitsu teaches that the base current of a bipolar transistor varies with the grain diameter of the polysilicon emitter, but does not specify that the base current of the bipolar transistor having a polysilicon emitter containing carbon is *lower* than the base current of an identical bipolar transistor with a polysilicon emitter not containing carbon.

Regarding claims 40-46, prior art does not teach or suggest, in combination with the other claimed limitations, a bipolar transistor having a single-crystal silicon emitter region and a polycrystalline silicon emitter layer in direct contact with a top surface of the single-crystal emitter region, wherein the emitter layer contains a dopant species

and an antimony species. Eklund (U.S. 5,150,184) teaches a bipolar transistor with a polycrystalline emitter that contains a dopant species and an antimony species, but does not teach a single-crystal emitter region in direct contact with the polycrystalline emitter layer (the polycrystalline emitter layer is in direct contact with the top surface of the base layer).

Response to Arguments

Applicant's arguments with respect to claims 20-26 have been considered, but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Heather A. Doty whose telephone number is 571-272-8429. The examiner can normally be reached on M-F, 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

had

DAVID BLUM
PRIMARY EXAMINER